



ENVIRONMENT, HEALTH & SAFETY DIVISION
Occupational Safety Group
Mail Stop 90K

Integrated Functional Appraisal (IFA)

Physics Division

June 10, 2003



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Executive Summary

The Physics Division has a generally satisfactory environment, safety, and health (ES&H) program. There is an active safety committee with broad representation by all segments of the Division, and serious hazards are well addressed.

There is room for improvement, particularly in areas relating to the formalities of the safety effort, such as work authorization, completion of required training, and updating of the Hazards, Equipment, and Authorization Review (HEAR) database.

The Physics Division has a large number of computer users with marginal ergonomic features. The Division also operates a number of facilities where much of the work is carried out under microscopes. In the past, there have been serious injury problems associated with this work, and some improvements have been made. Additional emphasis on ergonomics in these areas is appropriate.

Table of Contents

Section	Page
1 Introduction.....	1
1.1 IFA Purpose.....	1
1.2 Scope.....	1
2 Appraisal Process.....	1
2.1 Team.....	1
2.1.1 Selection.....	1
2.1.2 Member Roles and Responsibilities.....	1
2.1.3 Meetings	2
2.2 Defining Appraisal Areas	2
2.2.1 Document and Database Reviews.....	2
2.2.2 Identification of Facility-Level Operations	3
2.2.3 Identification of Medium- and High-Hazard Spaces and Operations	3
2.2.4 Identification of Higher Potential Line-Management- Authorized Work: Technical Work Spaces.....	3
2.2.5 Identification of Representative Nontechnical Work Spaces.....	3
2.2.6 Scheduling of Space Reviews/Inspections	3
3 Findings.....	4
3.1 Formal Work Authorizations.....	4
3.1.1 Status of Renewals.....	4
3.1.2 Current Personnel and Training.....	5
3.1.3 Authorization Content Reflects Current Conditions and Requirements	5
3.1.4 Review of Technical Occupational Safety and Health Issues	6
3.1.5 Validation of Hazard Identification Database (HEAR or Equivalent).....	6
3.1.6 Work Smart Standards Envelope.....	6
3.2 Line Management ('Self-Authorization') Space/Operations	6
3.2.1 Is Line-Management-Authorized Work Properly Identified?	7

Table of Contents

Section	Page
3.2.2 Validation of Hazard Identification Database (HEAR or Equivalent).....	8
3.3 Nontechnical Space/Operations	8
3.4 General Compliance Summary	8
4 Recommendations.....	8
5 Noteworthy Practices.....	9
6 Conclusion.....	9

Appendices

Appendix A	List of Facility and Formal Authorizations
Appendix B	List of Line Management Operations
Appendix C	Technical Occupational Safety and Health Inspection Findings
Appendix D	Photographs

1 Introduction

1.1 IFA Purpose

An Integrated Functional Appraisal (IFA) is performed for each division at Berkeley Lab once every three years. The IFA represents an in-depth technical review of environment, safety, and health (ES&H) activities and issues, with a special emphasis on operations that present the greatest hazards in the division.

1.2 Scope

Because of the small size of the Physics Division and the general low-hazard nature of the work in the Division, the IFA covered all areas with formal work authorizations, as well as most other non-office work areas. Some office areas associated with laboratories were also reviewed.

2 Appraisal Process

2.1 Team

2.1.1 Selection

Environment, Health and Safety (EH&S) Division team members were selected from those EH&S staff who are generally assigned to the Physics Division and are familiar with their operations in general. A DOE observer was identified by the Berkeley Site Office, and the Physics Division ES&H Coordinator was invited to participate in all activities of the team.

2.1.2 Member Roles and Responsibilities

Individual team members were expected to cover issues commensurate with their general expertise and responsibilities:

- Bob Fairchild: Radiation safety
- Carole Fried: Chemical safety, ventilation, industrial hygiene
- Matt Kotowski: General safety, shop safety, ergonomics
- Martha White: Waste management, waste minimization

In addition, the team consulted with Ted DeCastro, Laser Safety Officer and X-Ray Safety Officer, on matters relating to lasers and x-ray sources.

2.1.3 Meetings

The IFA began with an initial meeting on April 14, 2003. Physics Division Director Dr. James Siegrist joined the team for the opening of that meeting. During the meeting, available documents and data were reviewed, and the strategy for the IFA was determined. In addition, the team met and conferred in conjunction with specific site visits. The team also met on June 10, 2003, to discuss and finalize the report.

2.2 Defining Appraisal Areas

2.2.1 Document and Database Reviews

In preparation for the IFA, the team reviewed the following:

- FY 2000 Physics Division IFA
- 2002 Physics Division Self-Assessment Report, including the FY 2002 Management Review
- Berkeley Lab Self-Assessment Summaries 2000, 2001, and 2002
- Activity Hazard Document (AHD) Database
- AHD GS1002, Microsystems Lab Furnace Systems
- AHD 2014, LAM Research Model 4400 Plasma Etch System
- AHD 2049, Liquid Argon Test
- Sealed Source Authorization (SSA) 111, Class I
- SSA 114, Class II
- SSA 115, Class I
- SSA 203, Class II
- Low Activity Source Authorization (LAS) 002
- X-Ray Authorization 50-2155 (now inactive)
- Physics accident statistics, 1999–2003
- Chemical Inventory
- HEAR database

2.2.2 Identification of Facility-Level Operations

There are no facility-based authorizations associated with Physics Division operations.

2.2.3 Identification of Medium- and High-Hazard Spaces and Operations

Based on the available formal authorizations, the Micro Systems Laboratory in Building 70A, Rooms 4435–4437, and the Liquid Argon Test in Building 50, Room 6040, were identified as medium- or high-hazard spaces.

The operations involving sealed sources, while covered by formal authorizations, were not considered as medium- or high- hazard operations. The radiation safety specialist on the team reviewed all documentation and swipe records associated with the SSAs and found them to be current and complete.

2.2.4 Identification of Higher Potential Line-Management-Authorized Work: Technical Work Spaces

The IFA team decided to join forces with the Physics Self-Assessment team in visiting other non-office work areas. Most of the areas occupied by the Physics Division were visited in this manner. In no case were operations observed that would reach the trigger levels for formal authorizations.

2.2.5 Identification of Representative Nontechnical Work Spaces

A few office spaces associated with laboratories were visited, and the team reviewed computer work stations within laboratories.

2.2.6 Scheduling of Space Reviews/Inspections

Space reviews and inspections were scheduled through the Physics Division ES&H Coordinator. They were carried out for the most part in conjunction with the Physics Division Self-Assessment visits.

For the review of the Micro Systems Lab, an outside panel that was on site to review the Laboratory-wide self-assessment process also joined the team.

3 Findings

3.1 Formal Work Authorizations

The Physics Division has the following current formal work authorizations:

- AHD GS1002, Microsystems Lab Furnace Systems
- AHD 2014, LAM Research Model 4400 Plasma Etch System
- AHD 2049, Liquid Argon Test
- SSA 111, Class I
- SSA 114, Class II
- SSA 115, Class I
- SSA 203, Class II
- LAS 002
- X-Ray Authorization 50-2155 (now inactive)

3.1.1 *Status of Renewals*

The formal work authorizations for the Microsystems Lab are current.

AHD 2049, Liquid Argon Test, is lacking EH&S Division approval a year after its effective date of May 2002. The AHD was submitted to the EH&S Division for approval in May 2002, and the Laser Safety Officer met with the principal investigator at the time to discuss interlocking of the fiber optics that carry the beam to the experiment. This was not done to avoid electronic noise, and the researchers decided to use laser eye protection instead. However, the procedure was not amended, and the signoff was not completed. Necessary changes to the Engineering Safety Note were also not completed nor submitted at the time.

The experiment is now under review again, and the AHD and Safety Note will be revised and signed appropriately. The EH&S Division has also modified the hazard assessment procedures to preclude such oversights in the future.

Also note that X-Ray Authorization 50-2155 should be cancelled, given that the operation has been discontinued.

3.1.2 *Current Personnel and Training*

All personnel operating under the formal authorizations are current., This is assured by the principal investigator for AHDs. For the radiation authorizations (SSAs), this is also verified by the Health Physicist.

For training in general, Physics Division personnel have completed 79% of required training as of May 29, 2003. The 152 required training courses that have not been taken or that have been allowed to expire include the following:

Course No.	Course Title	# of individuals due for training
EHS0010	Introduction to ES&H at LBNL	19
EHS0060	Ergonomics for Computer Users	77
EHS0231	Compressed Gas Safety	4
EHS0256	Lockout/Tagout – OSHA	4
EHS0260	Basic Electrical Haz Awareness	16
EHS0281	Laser Safety Retraining	1
EHS0288	Laser Eye Exam	4
EHS0329	Lead Hazard Communication	1
EHS0342	Beryllium Hazard Com	3
EHS0348	Chemical Hygiene and Safety	1
EHS0405	Gen. Emp. Radiation Training	14
EHS0530	Fire Extinguisher Safety	3
EHS0604	Hazardous Waste Generator	1
NSD1007	Caves search & secure procedure	1
NSD3002	88" cyclotron shift experiment	2

3.1.3 *Authorization Content Reflects Current Conditions and Requirements*

The Physics Safety Committee reviews operations and operation changes on an ongoing basis. All research groups are represented on the committee. The formal authorizations reflect current conditions, except as noted for the liquid argon test AHD.

3.1.4 Review of Technical Occupational Safety and Health Issues

The operations in the Micro Systems Lab are all stable and have not changed substantively for years. While different designs of chips and charge-coupled devices (CCDs) are fabricated, the equipment, chemicals, and gases used remain the same. There are no new or novel hazards, and the existing AHDs cover the work adequately.

The Liquid Argon experiment did change since its inception in 2000, and a new AHD was prepared in May 2002. The AHD appropriately reflects operations and precautions, except as they pertain to Laser safety. As mentioned earlier, EH&S Division review and approval was not completed at the time.

3.1.5 Validation of Hazard Identification Database (HEAR or Equivalent)

The Physics Hazards, Equipment, and Authorization Review (HEAR) database was in the process of being updated during the review. However, there were many entries that had not been updated in two or three years. Because of the nature of the work, most of the HEAR information was still current, except for expiration dates of AHDs.

The Physics Division uses the Division Safety Committee to review new operations and changes in operations. Proposed experiments, facilities, and changes thereto are scheduled as safety committee agenda items and are reviewed during committee meetings. This is in addition to the AHD review for work with greater hazards.

3.1.6 Work Smart Standards Envelope

There have been no significant changes in the work of the division in this respect. The Work Smart Standards (WSS) envelope appropriately covers the work of the Physics Division.

3.2 Line Management ('Self-Authorization') Space/Operations

The majority of the work in the Physics Division is theoretical, analytical, or conceptual, and these operations involve mostly office and computer ergonomics hazards.

Actual laboratory work is mostly centered around design, fabrication, assembly, and testing of different types of detectors.

There is extensive collaboration with the Engineering Division in these endeavors. The hazardous portions of this work are carried out in the Microsystems Lab under approved AHDs.

During the past year, the Physics Division collaborated with the Engineering Division to develop an enhanced composite fabrication facility. An autoclave and a walk-in freezer were installed in and near Building 77A. There was extensive EH&S review during the selection, installation, and testing of this equipment. While the composite work will benefit mostly Physics Division programs and needs, the work will be carried out and authorized by the Engineering Division.

The remainder of the work is carried out in clean rooms and in light electronic laboratories in the Building 50 complex. Two clean room facilities were developed and installed in Building 50 since the last IFA, on the fourth floor and on the sixth floor. Both installations were reviewed by the Physics Safety Committee and by EH&S at the time.

Finally, there is a small machine shop on the sixth floor of Building 50, supervised by a machinist who is available to check out and authorize users, and who can provide machining assistance.

Most of the facilities are satisfactory, with some exceptions noted in the detailed findings.

Perhaps of greatest concern is the potential for ergonomic injuries associated with microscopy work. Few provisions have been made to facilitate ergonomically correct body positioning for personnel using microscopes. This was noted during the previous IFA, and little improvement is noted since then.

The Physics Division also collaborates with researchers at other institutions, and Berkeley Lab Physics personnel can be found working at SLAC, Fermilab, CERN, and even at the South Pole. Often this involves only data taking, but at times it also involves collaboration in the installation of instruments and detectors. In previous years, the Physics Safety Coordinator validated and confirmed training requirements for personnel working at such offsite facilities. Since all of the DOE facilities had requirements and enforcement similar to LBNL, this effort was discontinued. The work at the South Pole is under the direction of the Air Force, and all personnel are outfitted and trained by the Air Force for cold-weather conditions.

3.2.1 Is Line-Management-Authorized Work Properly Identified?

The Physics Division Safety Committee reviews all Physics experimental work. During this process, work that needs formal

authorizations is identified. We observed no operations that require formal authorizations that do not have them. The process seems to work well.

3.2.2 Validation of Hazard Identification Database (HEAR or Equivalent)

Physics used to have a system of experiment review sheets, which authorized all laboratory work. During the past few years, Physics has migrated to the HEAR database, but updating has been less frequent than annual.

3.3 Nontechnical Space/Operations

A sample of offices and computer workstations associated with laboratories was reviewed. While there were no significant violations of standards, computer ergonomic issues were noted in a number of instances. These, and the number of individuals not having completed required ergonomics training, indicate that additional emphasis on computer ergonomics is warranted.

3.4 General Compliance Summary

1. No serious violations of OSHA standards and no serious physical hazards were noted.
2. Compliance with mandatory training requirements is only at 79%, the second lowest at the Laboratory.
3. The Liquid Argon Test has been operating for a year without a fully approved AHD.
4. Hazard tracking in the HEAR database is mostly correct, but was found to be mostly overdue for updating.

4 Recommendations

1. Additional attention should be paid to improving the ergonomics for microscopy work and for computer use.
2. Work requiring AHDs should not be undertaken until all required approvals have been obtained.
3. Additional attention should be given to completing mandatory training in a timely manner.

4. Use of the HEAR database for tracking and authorizing work in all spaces should be improved.

5 Noteworthy Practices

In 2002, the Physics Division Safety Committee undertook a “vertical slice” survey of employees to verify that students, technicians, researchers, supervisors, and group leaders implemented safety requirements. This represented a significant and worthwhile effort, and it helped to pinpoint the strengths and weaknesses of the Physics Division safety approach.

6 Conclusion

The Physics Division has a satisfactory ES&H program.

There is room for improvement, in particular in areas relating to the formalities of the safety effort, i.e., authorization of work (Liquid Argon), completion of required training, and updating of the HEAR database. Additional emphasis on ergonomics would also be appropriate.

Appendices

Appendix A List of Facility and Formal Authorizations

Appendix B List of Line Management Operations

Appendix C Technical Occupational Safety and Health Inspection Findings

Appendix D Photographs

Appendix A List of Facility and Formal Authorizations

The following Formal work authorizations are currently held by the Physics Division:

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- AHD 2014, LAM Research Model 4400 Plasma Etch System
- AHD 2049, Liquid Argon Test
- SSA 111, Class I
- SSA 114, Class II
- SSA 115, Class I
- SSA 203, Class II
- LAS 002
- X-Ray Authorization 50-2155 (now inactive)

Appendix B List of Line Management Operations

LBNL Physics Division Research Program

Experiments at Particle Accelerators

ATLAS

Experiment at the CERN to explore the origin of mass

BABAR

Experiment at the SLAC B-Factory for observation of CP violation

CDF

Experiment at the FERMILAB Tevatron proton-antiproton Collider

D0

Experiment at the FERMILAB Tevatron proton-antiproton Collider

E871

Experiment at FERMILAB to search for CP violation in the hyperon decay

Astrophysics

INPA

Institute for Nuclear and Particle Astrophysics

CfPA

Center for Particle Astrophysics at UC Berkeley

COBE

Experiment on the evidence for the Big Bang

Distant Supernova Search Experiment

Appendix B List of Line Management Operations

SNAP Supernova / Acceleration Probe

Dark Matter | Direct Detection | MACHO and Stromlo/SSO

Km3

KamLAND

Glacial cycles, lunar craters, and Nemesis

Theoretical Physics

Particle Data Group (PDG)

Particle Physics reviews and database

Detector R&D

Microsystem Lab

High-resistivity **CCD** development

Gas Microstrip Detectors

HEP Detector Electronics Design

Medical Imaging

High-resolution X-ray Imaging

Appendix C Technical Occupational Safety and Health Inspection Findings

Building	Room	Finding	Action
50	2155	There were unlabeled chemicals containers.	Chemicals should be properly labeled and disposed of if no longer needed.
50	2155	A container of Jasco paint stripper containing methylene chloride was found.	Paint strippers not containing methylene chloride should be used, to eliminate the need for extensive safety precautions.
50	4002	There is little separation between chemicals and food storage and preparation.	Food should not be prepared or consumed in laboratories where chemicals are handled.
50	4002	An extension cord was draped across a work space to provide power to a piece of equipment.	Eliminate the improper use of extension cords.
50	4003	Chemicals no longer used were stored on the floor and have been there for two years.	Dispose of chemicals no longer used promptly.
50	4003	There is excessive crowding, which limits aisle spaces.	Provide an aisle at least 28" wide through the room.
50	4003	There were unsecured gas cylinders standing in the room.	Provide standard devices or chains for securing the gas cylinders.
50	4005	There is excessive overhead storage, creating a seismic hazard.	Eliminate all storage of parts and equipment above a height of seven feet.

Building	Room	Finding	Action
50	4004–4008	There is extensive use of microscopes in this area, with little attention to ergonomic issues.	Consider providing arm rests and wedges and ocular extension tubes to allow ergonomically more correct body positioning while working at microscopes.
50	4004-4008	Two HEPA vacuums were noted that are not routinely tested.	The HEPA vacuums have been added to the IH Group's list for routine testing.
50	6007	Satisfactory	
50	6016B	Satisfactory	
50	6035	Exceptionally neat and orderly machine shop	
50	6035	A leaky oil can was found in the flammables cabinet.	Replace leaky oil can and clean up spilt oil.
50	6040	Satisfactory	
50	6040A	Two file cabinets and a tall instrument rack lack seismic bracing.	Provide seismic bracing for two file cabinets and a tall instrument rack.
50B	6209	Two tall instrument racks were not seismically secured.	Provide seismic anchoring for all equipment more than three feet tall.
50B	6209	Many computers on lab tables, including laptop computers, pose ergonomic concerns.	Request ergonomic evaluations for computers that are used for more than a few minutes at a time. Provide laptop holders (similar to keyboard trays) and foot rests as needed.
50B	6238A	Three computers on a desk pose obvious ergonomics problems.	Request an ergonomic evaluation for the computer user.
50B	6238	Tool boxes in the exit passage for Room 6238A may block the exit passage in case of an earthquake.	Provide seismic securing for the tool boxes.

Building	Room	Finding	Action
50B	6238	The storage cabinets near the exit are not secured against earthquakes.	Provide seismic securing for the storage cabinets.
50B	6238	Many microscope work stations have obvious ergonomic deficits.	Provide additional attention to ergonomic needs for microscopy work.
50B	6238	Housekeeping is poor, with many trip hazards and obstructed aisle ways.	Improve housekeeping.
50B	6238	Several chemical containers lack the required labels.	Label chemicals and track them more thoroughly in the chemical inventory database.
50B	6238	There was less than satisfactory knowledge about the hazards and corresponding safety precautions for the epoxy compounds used.	Provide improved hazard communication for personnel in this area using chemicals.
70A	4435	HF compounds are stored in a chemical storage cabinet.	Provide gluconate gel near the chemical storage cabinet for immediate first aid application.
70A	4445	Slot ventilation was last calibrated 4/19/01.	EH&S to recalibrate slot ventilation and schedule for annual calibration.
70A	Hall near 4445	Fire extinguisher inspection out of date	Fire Protection notified. (Institutional issue)

Appendix D Photographs

Photo 1.

Microscopy station without arm rests, work level at an awkward height.



Photo 2. Microscopy stations with inadequate seating, inadequate leg room.



Photo 3. Microscopy station at an awkward height, no arm rests, marginal seating.



Photo 4. Microscopy station with no arm rests inadequate space.